CURRICULUM
QA
14
C22
A3
A3152
1965
CURRGDHT
ALTA
510
1965
Gr10
CURR

IM - 1341
AW 8553
Aug. 3/67

# Curriculum Guide for Mathematics 10

DEPARTMENT OF EDUCATION
EDMONTON, ALBERTA
SEPTEMBER, 1965.

## TABEL OF CONTENTS


Preface ..... 1

Objectives of the Senior High School Mathematics Program ..... 2

Perspective ..... 3

Some Principles for Effective Mathematics Instruction ..... 4

Objectives of Mathematics 10 ..... 5

Course Outline for Mathematics 10 ..... 5

Geometry ..... 6

Set Summary ..... 7

Suggestions for Teaching Mathematics 10 - Algebra ..... 8

Suggestions for Teaching Mathematics 10 - Geometry ..... 12

Chapters I - VII ..... 8 - 12

Chapters VII - XV ..... 15 - 17

## PREFACE

Mathematics curricula are in the process of revision from first grade to university post-graduate level. Various authorities submit differing statements regarding reasons for this revision. A concensus of these statements is the following:

1. An explosion of knowledge has taken place in the field of mathematics in the last fifty years resulting in new areas of study such as topology and abstract algebra. Courses in high school besides enabling other objectives to be attained must prepare students to advance in various areas of mathematics at the university level. Emphasis is therefore placed on the basic structures and patterns which pervade the entire field of mathematics e.g. mathematical systems and functions. This emphasis on basic structures and patterns is evident in contemporary developments in the curriculum of all subject areas.

2. The conventional grade placement of various topics is being reassessed in order to determine when concepts can be most effectively and efficiently taught. For example, in some experimental programs much more geometric content has been taught successfully to junior high school students.

3. Curriculum change in the last decade has been characterized by increasing emphasis on the intellectual aims of education.

4. Some mathematical concepts are decreasing in importance: for example, logarithmic solutions of oblique triangles. Because these concepts are of decreasing importance their emphasis in high school mathematics curricula is decreasing.

The Junior High School Mathematics courses have been or are being revised. It is expected that students will in a short time come to the senior high school better prepared, and that they will be able to study successfully programs that tend to be different in content and emphasis than those that have been pursued in the past. The Mathematics 10 course outlined in the guide represents a modest revision which is designed to enable the student to attain the objectives of all Mathematics courses in the senior high school to a higher degree even though they have not studied revised programs in the junior high school. The course outlined should enable the teachers who are keeping abreast of developments in the discipline to introduce new approaches; furthermore, it is hoped that the introduction of new material will alert more teachers to the advisability of becoming acquainted with the many new programs that have been written. The bibliography toward the latter part of the publication lists many good sources of material.

## OBJECTIVES OF THE SENIOR HIGH SCHOOL MATHEMATICS PROGRAM

While the academic, vocational and commercial sequences of courses have different specific objectives the common general purposes of Senior High School Mathematics courses are as follows:-

1. To develop an understanding of mathematics as a creation of man and to develop an appreciation of the contribution of this discipline to the progress of civilization.

2. To develop precision in thought and expression.

3. To develop and maintain an understanding of the operations and concepts of mathematics.

4. To develop and maintain skill in mathematical operations.

5. To develop powers of logical analysis of problems and of presenting their solution in a clear and precise manner.

## PERSPECTIVE

The effective mathematics teacher must know how the concepts taught in a particular grade fit into the general development of the subject. In this way needless repetition of the work of previous grades will be avoided. In addition, the teacher will know which concepts are new and require careful presentation and which concepts involve a review of the notions previously taught. If the teacher is aware of concepts to be developed in succeeding grades, problems resulting from carrying an area study too far can be avoided. The teacher of Mathematics 10 or Mathematics 20 therefore should familiarize himself with the curriculum outlined for Mathematics 9, 10, 20, 30, and 31.

To assist the teacher, a chart of the mathematics program in Grade IX and the academic program of the senior high school is presented on the following page. It has been found that staff meetings and meetings at other administrative levels are advantageous in acquainting teachers with the mathematics program of Grades IX to XII. If these meetings are held early in the fall they will be of maximum value.

## SOME PRINCIPLES FOR EFFECTIVE MATHEMATICS INSTRUCTION

Mathematics teaching can be made more effective by applying the following principles:-

1. Readiness is an important aspect of every learning situation. It is especially important in the subject of mathematics because of the sequential nature of the material. Before new material is presented a brief review of concepts necessary for the understanding of the material is strongly advised.

2. Teaching is most effective when students are encouraged to formulate their own generalizations. As this approach is time-consuming it cannot be used throughout a course. It should be utilized, however, as much as time permits.

3. The effective mathematics teacher realizes the importance of growth in mathematical reading ability and is aware that the reading of mathematics involves a special vocabulary and special skills. Towards this end the mathematics teacher assumes these responsibilities:

   (a) He teaches the students the special skills that are necessary. e.g. reading slowly, re-reading several times, etc.

   (b) He encourages the reading of related references and library books about mathematics.

   (c) He gives attention to the development and review of a mathematics vocabulary.

4. Some students learn best through the sense of sight, some through the sense of hearing and some through the sense of touch, consequently concrete materials such as diagrams, pictures, charts and mathematical models should be utilized whenever possible in the development of a mathematical concept.

5. If students are to grow in accordance with their ability some attempt must be made to accommodate children with modest ability and children with much ability. Individualized instruction, varied assignments, drill with selected students, library reading assignments, term papers and problems of the week are some procedures that have been used by successful teachers to differentiate instruction.

## MATHEMATICS 10

**Objectives of Mathematics 10**

1. To review and extend students' knowledge of basic geometric understandings as part of the literacy of today's average citizen.
2. To give high school students an appreciation of proof strategy; to distinguish between inductive proof and deductive proof.
3. To give students some appreciation of the development of a logical mathematical system through a study of geometry and algebra.
4. To provide opportunities for original and creative thinking by students. Part of the course should be devoted to original exercises involving both the discovery of relationships and their proofs.
5. To develop an understanding of the properties of the various number systems and to apply these properties in the development of algebraic concepts.
6. To develop and maintain skill in mathematical operations.

## COURSE OUTLINE FOR MATHEMATICS 10

**Text:**

SECONDARY SCHOOL MATHEMATICS, Grade 10 — MacLean et al

**Teacher References:**

TEACHING NOTES, SECONDARY SCHOOL MATHEMATICS, Grade IX and X — MacLean.

GEOMETRY, (Teacher's Edition), Moise and Downs.

MODERN ALGEBRA, Book I, (Teacher's Edition), Dolciani, Berman and Freilich.

These references may be obtained from the School Book Branch, 104 Ave. and 121 St., Edmonton.

NOTE:-

It is recommended that students use mathematical tables whenever possible. Teachers should encourage students to obtain individual copies of **Knott's Mathematical Tables** (revised edition) or **Castle's Five-figure Logarithmic and Other Tables** and should give instruction in the use of these tables.

| *Content: | Suggested Time (Weeks) |
|---|---|
| 1. Sets (Review A) | 1½ |
| 2. Natural Numbers and Zero, Integers (Review B) | 1½ |
| 3. Rational Numbers, Irrational Numbers, Real Numbers (Chapter 1) | 3 |
| 4. Equations and Inequations (Chapter 2) | 2½ |
| 5. Problem Solving (Chapter 3) | 2 |
| 6. Factoring Polynomials (Chapter 4) | 3 |
| 7. Simplification of Rational Expressions (Chapter 5) | 1½ |
| 8. Relations (Chapter 6) (Optional) | |
| 9. Systems of Linear Equations (Chapter 7) (Optional) | |

**Sections of the text listed as supplementary are not included in the minimum course.*

## GEOMETRY

| | | |
|---|---|---|
| | Introduction, General Principles, Fundamental Constructions and Inductive Reasoning (Review C and D) | 3 |
| 1. | Introduction to Deductive Reasoning (Chapter 8) | 2 |
| 2. | Fundamental Angle Pair Theorems (Chapter 9) | 1 |
| 3. | Congruence (Chapter 10) | 2½ |
| 4. | Converse Statements, Converse Theorems (Chapter 11) | 1½ |
| 5. | Indirect Proof, Inequations (Chapter 12) | 1 |
| 6. | Parallel Lines (Chapter 13) | 3 |
| 7. | Areas of Polygons (Chapter 14) | 1½ |
| 8. | Ratio and Proportion, Similar Figures (Chapter 15) | 2½ |
| | | 18 Wks |

Note: See page 22 for suggested optional treatment of Chapters 14 and 15.

This suggested time schedule provides broad limits to guide the teacher in covering the course. More specific suggestions are provided for each section. Teachers able to keep within these broad limits will have time to treat the optional chapters and some of the sections listed in the text as supplementary.

## SET SUMMARY

**Set Construction**

- Tabulation:
  $A = \{ \text{Calgary, Edmonton, Red Deer} \}$
- Description:
  $B = \{ x \mid x \text{ is a city in Alberta} \}$

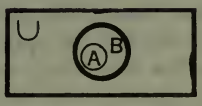
(See page 70)

**Kinds of Sets**

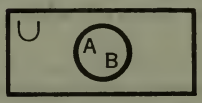
- Finite:
  $T = \{ 2, 4, 6, 8, \ldots, 20 \}$
- Infinite:
  $M = \{ 2, 4, 6, 8, \ldots \}$
- Null:
  $S = \{\ \}$ or $S = \phi$

**Set Relations**

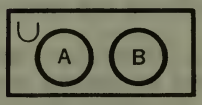
- Proper Subset:
  $A \subset B$
  $\phi \subset B$




- Identical:
  $A = B$



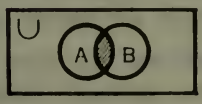

- Disjoint:
  A and B are disjoint




- Equivalent:
  $n(A) = n(B) \begin{cases} A = \{ a, b, c \} \\ B = \{ x, y, z \} \end{cases}$

**Set Operations**

- Intersection:
  $A \cap B$




- Union:
  $A \cup B$

## SUGGESTIONS FOR TEACHING MATHEMATICS 10 — ALGEBRA

**Content**

For the first year of authorization of **Secondary School Mathematics, Grade Ten,** namely 1965-1966, the minimum course in algebra will consist of:

Review A and Review B

Chapters I to V inclusive

Capable students should be encouraged to study Chapters VI and VII also. Suggested topics from Chapters VI and VII that might well supplement the minimum requirements have been added to the algebra outline.

Careful preparation on the part of the teacher is essential. A preliminary survey of the entire textbook, followed by a careful study of the mathematics in each chapter prior to presentation, is recommended.

For the guidance of the teacher, a suggested time schedule for each chapter is given. The schedule does not include time for review and testing. For the purposes of the Guide a period is defined as being approximately forty minutes in length.

**Review A and Review B**

The topics presented in Review A and Review B will be new to students who have had a strictly traditional background in mathematics. Since the ideas presented are basic to the treatment of the algebra and geometry that follows, it is essential that they be presented clearly. Nothing may be omitted. MacLean's **Teaching Notes,** listed under Teachers' References, will prove useful to the teacher whose background in the newer mathematics is inadequate.

In Review A sets are introduced and classified. The ideas are quite elementary. There is no "set theory" as such, the main purpose of the chapter being to provide the vocabulary needed for applying the fundamental concept of "set" to later work. Since this is a first exposure, rather than a review, a good procedure is to cover the material rather quickly and then reinforce it by using the new vocabulary wherever possible in the material which follows. Correct form in notation is essential at all times.

The following chart may serve as a summary of the basic set understandings that are essential for the work ahead:

Review B presents and summarizes the properties of both the natural number system (N) and the integer system (I), thus giving a preliminary idea of a logical mathematical structure. $N_0$ represents the natural numbers with the addition of zero.

N, $N_0$, and I qualify as number systems because:

1. each has a set of members.
2. each has two binary operations: addition and multiplication.
3. each set is closed, commutative, and associative with either operation.
4. in each, the second operation is distributive over the first.

The proofs that are given for operations in the set of integers should be discussed with the students. Considerable satisfaction is likely to result when the students are able to arrive at the product of a positive and a negative integer through proof, rather than by means of a memorized rule. When working with integers try to remember to use the terms "positive" and "negative" rather than "plus" and "minus". Also, note carefully the author's cautions regarding operations involving zero. Clear understanding at this stage will minimize difficulty later.

**Recommended Time Schedule**

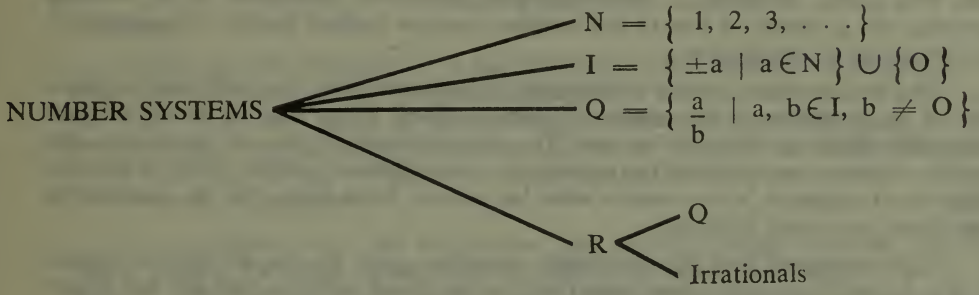
Fifteen periods, distributed as follows:

Sections A.1 to A.5 — 5 periods
Sections B.1 to B.3 — 3 periods
Sections B.4 to B.9 — 5 periods
Sections B.11 to B.13 — 2 periods

## CHAPTER I

### Rational Numbers, Irrational Numbers, Real Numbers

The systems of rational numbers (Q) and real numbers (R) are extensions of the system of natural numbers (N). N is isomorphic to a subset of Q. In other words, under the operations of addition and multiplication, the sets $\{1, 2, 3, \ldots\}$ and $\left\{\frac{1}{1}, \frac{2}{1}, \frac{3}{1}, \ldots\right\}$ behave in the same way.




A chart such as the following indicates the basic ideas and language which makes one aware of the structure of a number system.

PROPERTIES OF R:

If a, b, c, $\in$ R, then:

| | ADDITION | MULTIPLICATION |
|---|---|---|
| CLOSURE | (a + b) represents one and only one real number | (ab) represents one and only one real number |
| Commutative Property | a + b = b + a | ab = ba |
| Associative Property | (a + b) + c = a + (b + c) | (ab)c = a(bc) |
| Distributive Property | a(b + c) = ab + ac | |
| Identity Element | zero | unity |
| Inverse Element | (—a) | $\left\{\frac{1}{a}\right\}$ |
| Order — Dichotomy (See page 275) | $a = b$ or $a \neq b$ | |
| Order — Trichotomy | $a < b$ or $a = b$ or $a > b$ | |
| Order — Transitive | If $a < b$ and $b < c$ then $a < c$ | |
| Completeness | Each point on the number line corresponds to a real number and each real number corresponds to a point on the number line. | |

It is suggested that teachers and students use the terms indicated in the chart whenever an opportunity arises. It is extremely difficult to proceed without them. Familiarity comes with use.

Related topics discussed in this chapter include: recurring decimals, laws of exponents, and scientific notation. Again, don't overlook special comments regarding zero.

**Recommended Time Schedule**

Fourteen periods, distributed as follows:

Sections 1.1 to 1.8 — 5 periods
Sections 1.9 to 1.15 — 3 periods
Sections 1.16 to 1.23 — 6 periods

## CHAPTER II

In this chapter there are two main departures from the traditional treatment. The first is the recognition that a given equation or inequation is the defining sentence for a subset of one of the number systems studied earlier. The second is the inclusion of inequations.

The first of these results in equations being solved by the deliberate application of the properties of the number system involved, rather than by means of rules of thumb which are learned by rote. This should result in greater insight into the number systems and provide the opportunity for algebraic proofs. What is actually done to an equation is very much what has always been done, but the reasons for operations are more obvious.

It is suggested that the set-builder notation, page 70, be introduced earlier, in the A and B sections. Note also that the graphs of solution sets are not necessarily continuous lines but may be disconnected sets of points. The latter part of the chapter provides material which can be used to reinforce the ideas of union and intersection learned in Review A.

**Inequality Relations**

Theorems (with proofs) should be discussed with the class. Perhaps one of the theorems of pages 79, 80 and 81 could be examined closely and the actual proof of the others be used as enrichment material. Note in particular the theorem: The sense of an inequality is reversed if each member is multiplied or divided by the same negative real number.

**Absolute Value**

Section 2.10 is straightforward. If a teacher chooses to do the supplementary section, 2.11, it is recommended that he not present $| x - 3 | = 2, x \in R$ as it is given on page 91.

Rather, let the argument be:

| | |
|---|---|
| $-(x - 3) = 2$ | $x - 3 = 2$ |
| $-x + 3 = 2$ | |
| $\therefore x = 1$ | $\therefore x = 5$ |

By insisting on correct absolute form, confusion will be avoided with questions involving inequalities.

**Recommended Time Schedule**

Twelve periods distributed as follows:

Sections 2.1 to 2.4 — 4 periods
Sections 2.5 to 2.8 — 4 periods
Section 2.9 — 1 period
Section 2.10 and review — 3 periods

## CHAPTER III

**Problem Solving**

Perhaps during the first year teachers may wish to tackle this as a complete chapter in order to become acquainted with the book.

Problem solving, however, should not be considered a section of a textbook set apart from other topics. It belongs in every chapter since problem solving involves the application of mathematical skills to the solution of real problems. Some teachers prefer to assign several problems each week throughout the year rather than concentrate on solving verbal problems for a short period of time.

Note that the description of the variables used in a problem, as illustrated near the bottom of page 102, is very complete.

**Recommended Time Schedule:** Nine periods

## CHAPTER IV

**Factoring**

There are two approaches to the factoring of polynomials of more than one term. One approach is that of the distributive law and the other that of the factor theorem. No proof is given for the theorem and when it is used the pupil needs to be able to do "long division" in algebra. Since this is not in the Grade IX course, it will have to be taught—the only example in the text is the one used for illustrative purposes on page 141.

In connection with the distributive law and the factor theorem the pupil should realize that once a particular method of factoring has been justified on the basis of either principle, the method may then be used without reference to the principle in every case. See the treatment of the differences of squares on page 132.

The types of factoring required are summarized on page 142.

**Recommended Time Schedule**

Fourteen periods distributed as follows:

Sections 4.1 to 4.5 — 3 periods
Sections 4.6 to 4.10 — 5 periods
Sections 1.11 to 4.14 — 6 periods

## CHAPTER V

This chapter is quite traditional in content. Since it contains many exercises, a selection should be made. Note the use of the principle of equivalent fractions which was developed in Chapter One. Also note the statement of the conditions under which one fraction is equal to another.

$\frac{x^2 - 1}{x - 1} = x + 1$ only if $x \neq 1$, since division by 0 is not a defined operation.

**Recommended Time Schedule**

Six periods distributed as follows:

Sections 5.1 to 5.3 — 1 period
Sections 5.4 to 5.5 — 1 period
Section 5.6 — 2 periods
Section 5.7 — 1 period
Review or test — 1 period

## CHAPTER VI

**Relations (Optional)**

Although this is a most interesting chapter, it is likely to prove time-consuming. It is recommended that the following sections be included in the course if time permits: Sections 6.1, 6.2, 6.3.

These sections deal with binary relations, ordered pairs from a cross product, and graphs of ordered pairs. If time permits, the students will enjoy the work with simple relations in Sections 6.4, 6.5, and 6.6.

## CHAPTER VII

**Systems of Linear Equations (Optional)**

If time permits, teachers should introduce the solution of a system of equations by elimination of a variable, using the "Substitution" Method and the "Addition and Subtraction" Method. Sections 7.1, 7.2, 7.3.

Treat this section lightly. Assign some practice involving each method. Apply also to a few problems.

The section dealing with systems involving more than two variables is excellent enrichment material.

## SUGGESTIONS FOR TEACHING MATHEMATICS 10, GEOMETRY

**Everyday Knowledge of Geometry**

In today's world, knowledge of basic arithmetic is not enough. Adults need to know some elementary facts of algebra and geometry as well.

The Grade X pupil has already met many elementary geometric concepts in his junior high school work. Among these are:-

1. Notion of point, line, straight line.
2. Notion of angle and kinds of angles.
3. Adjacent, vertically opposite, supplementary and complementary angles.
4. Ideas of parallelism and of perpendicularity.
5. Polygons, triangles, kinds of triangles, parallelograms, special forms of the parallelogram.
6. Experimental treatment of the angle sum of any triangle.
7. Notion of congruence; three conditions for congruence of triangles.
8. Properties of similar rectilinear figures.
9. Experimental treatment of the angle sum of any triangle.
10. Notion of converse.
11. Certain geometric constructions such as:-
    —how to bisect a line or angle;
    —how to draw a perpendicular to a line;
    —how to copy a triangle.

These geometric facts and concepts need review, reinforcement and extension.

**Proof Strategy**

The pupils should learn:-

(a) to distinguish between inductive and deductive reasoning, to appreciate the limitations of the former and its vital role in the development of knowledge; to apply both inductive and deductive reasoning in mathematics;

(b) to recognize the nature and importance of definitions and assumptions in deductive reasoning, to recognize the characteristics of good definitions

and to formulate simple definitions of familiar concepts, to be alert to hidden assumptions and to challenge unsubstantiated statements;

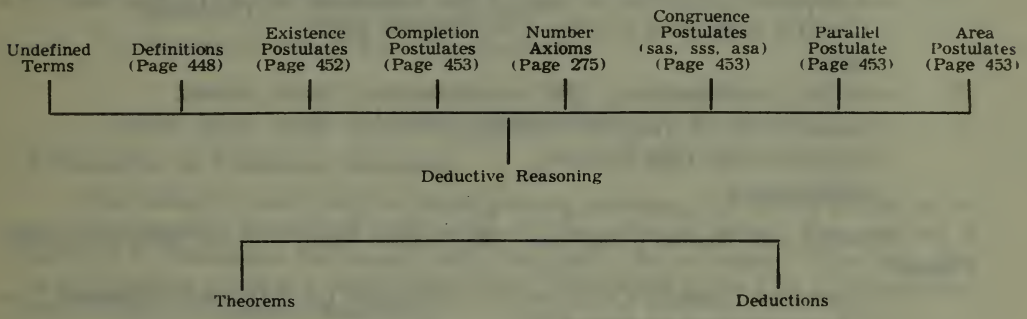
(c) to understand the method of indirect proof and to apply it in simple situations, both geometric and non-geometric (mathematical and non-mathematical);

(d) to distinguish between analytic and synthetic methods of proof; to apply analytic procedures to the solution of original theorems, exercises and constructions; then, having discovered the solution, to formulate a synthetic proof.

The abler students or classes of superior pupils might be introduced to the inverse and converse of a propositional statement such as a definition, an assumption or a theorem. Students should use the contrapositive in proof and should be able to distinguish between "necessary" and "sufficient" conditions.

### The Structure of Geometry as a Logical System

This chart, which appears on page 424 of the text, summarizes the way in which geometry is developed in this course. It could well be used to introduce this section and as a ready reference as the course develops.




Angle
1. Complementary Angle Theorem
2. Supplementary Angle Theorem
3. Vertical Angle Theorem

Basic Biconditional
4. Isosceles Triangle Theorem
5. Right Bisector Theorem
13. Angle Bisector Theorem

Inequality
6. Exterior Angle Theorem

Parallel
7. Parallel Line Theorem
8. Quadrilateral-Parallelogram Theorem
9. Parellelogram Theorem
10. Triangle Angle Sum Theorem

Congruence
11. As Congruence Theorem
12. Right Triangle Congruence Theorem

Area
14. Parallelogram Area Theorem
15. Parallelogram-Diagonal Theorem
16. Parallelogram-Triangle Area Theorem
17. Equal Triangle-Parallel Line Theorem
18. Pythagorean Theorem
19. Pythagorean Converse
20. Trapezoid Area Theorem

The text provides many exercises of varying degrees of difficulty. Teachers are advised to select exercises in accordance with the needs and abilities of their classes. In many cases if teachers make a judicious selection of exercises in one section, the students will have, in fact, developed the theorems introduced in the following section. e.g. Exercise #9, page 293 is the vertical angle theorem which is proven on page 291.

**Review C: General Principles**

This review sets down some of the undefined terms and relations.

**Undefined Terms:** set, point, line, plane.

**Undefined Relations:** belongs to, lies on, is equal to.

The characteristics of a good definition are now set forth. The following terms are **defined:**

—line segment, half-line, ray, angle, triangle;

—classification of triangles according to sides: scalene, isosceles, equilateral;

—half-plane, boundary or edge of the half-plane, dihedral angle, edge of a dihedral angle, face or side of the dihedral angle;

—circle;

—angles: supplementary, right, complementary, acute, obtuse;

—classification of triangles according to angles: acute, right, obtuse;

—perpendicular, right bisector;

—betweenness.

Through the discovery exercises, this chapter brings out the following **postulates:**

—Discovery Exercise C-2 is used to formulate the **Existence Postulates** 1 to 12, summarized on page 452.

—Discovery Exercise C-3 is used to formulate the **Measurement Postulates** 13 to 15, **Betweenness Postulates** 16 to 18, and **Completion Postulates** for line segments (page 241) and for angles (page 245).

**Recommended Time Schedule**

Eight periods distributed as follows:

Sections C.1 to C.3 — 3 periods
Section C.4 — 2 periods
Sections C.5 to C.7 — 3 periods

**Review D: Fundamental Constructions, Inductive Reasoning**

The fundamental ruler-compasses constructions listed below are essentially a review of work done in Grade IX.

—angle construction.

—right bisector of a given angle.

—line segment perpendicular to a given line segment at a given point on it.

—line segment perpendicular to a given line segment from a point not on the line.

—right bisector of a given line segment.

—line parallel to a given line on a given point not on the line.

**Inductive Reasoning**

The set of exercises on page 256 is used to make conjectures which lead to deductions, some of which are later proven in this text. It is not essential that all students do all exercises; a variety of approaches—group work, oral work, homework should be used. The essential point is that students develop the concept that constructions may lead to conjectures as indicated below:

—the altitudes of a triangle are concurrent.
—the medians of a triangle are concurrent.
—the bisectors of the angles of a triangle are concurrent.
—the right bisectors of the sides of a triangle are concurrent.
—there exists a circumscribing circle for any triangle.
—the orthocentre, the centroid, the circumcentre of a triangle are collinear.
—the exterior angle of a triangle is greater than either interior remote angle.
—the parallel line relationships.

**Recommended Time Schedule**

Five periods distributed as follows:
Sections D.1 to D.2 — 2 periods
Sections D.3 to D.4 — 3 periods

## CHAPTER VIII

**Introduction to Deductive Reasoning**

The student is now ready to begin proving theorems, but before he can do so he must become acquainted with some of the rules of proof. This chapter is intended to familiarize the student with "accepted rules of logical inference". The proof strategies which are introduced are the applications of the Law of Detachment and the use of syllogistic reasoning.

The students are given considerable practice here in building a formal deductive proof (synthesis) using non-geometric material. Much practice is provided also in using analysis to discover the plan for a formal proof.

Before introducing deductions using geometric material, the teacher should familiarize the pupils again with the basic postulates and number axioms listed on pages 274-275. At this point the student would be required to write out very carefully the analysis and the proof of the deductions.

**Recommended Time Schedule**

Nine periods distributed as follows:
8.1 to 8.5 — 6 periods
8.6 to 8.7 — 3 periods

## CHAPTER IX

**Fundamental Angle Pair Theorems**

Definitions: corollary, vertical angles.
Theorem 1: Complementary Angle Theorem
Theorem 2: Supplementary Angle Theorem
Theorem 3: Vertical Angle Theorem

**Recommended Time Schedule:** Four periods

## CHAPTER X

**Congruence**

The degree of precision in the presentation of the postulates in 10.1 is extremely important because it is basic to the work that follows. The congruence postulates presented include those for line segments, for angles and for triangles.

—SAS

—SSS

—ASA (Note that in the **postulate** the side must be contained between the two angles. On page 381 the AAS congruence **theorem** is proven.)

It is suggested that teachers continue to require the analysis and the proof for deductions. However, students could now begin to give the analysis orally for the easier deductions. There is a danger of killing interest if students are made to provide both written analysis and proof. Encourage students to use analysis instead of proof for more difficult deductions. In subsequent chapters, **either** of the two procedures should be accepted. The authors tend to favor analysis.

**Recommended Time Schedule**

Twelve periods distributed as follows:

Section 10.1 — 1 period
Sections 10.2 to 10.3 — 4 periods
Sections 10.4 to 10.5 — 4 periods
Sections 10.6 to 10.7 — 3 periods

## CHAPTER XI

**Converse Statements, Converse Theorems**

Definition: converse theorem

Rule of proof: The truth of an implication does not guarantee the proof of its converse.

If, and only if connective; biconditional statements.

Theorem 4: Isosceles Triangle Theorem

Theorem 5: Right Bisector Theorem

It should be noted that some authors use the term "iff" to express the "if and only if" connective, as well as the double arrow symbol.

**Recommended Time Schedule:** Eight periods.

## CHAPTER XII

**Indirect Proof Inequalities**

In this chapter a new proof strategy is introduced—the use of the Law of Contradiction in developing an indirect proof. The steps in an indirect proof are listed and Theorem 6 (Exterior Angle Theorem) is developed.

**Recommended Time Schedule:** Five periods.

## CHAPTER XIII

**Parallel Lines**

At this time it would be appropriate to review definitions developed in Review D. The parallel postulate should be emphasized as well as Theorem 7 which is basic. Since this chapter tends to be long, certain theorems, e.g. Theorem 8, may not need to be developed formally since the relationship will have been proven in previous exercises. 13.12—Plans may be considered optional.

**Recommended Time Schedule**

Fifteen periods distributed as follows:

Sections 13.1 to 13.5 — 6 periods
Sections 13.6 to 13.11 — 9 periods

## CHAPTER XIV

**Areas of Polygons**

Sections 14.1 to 14.4 inclusive should be covered thoroughly since they deal with the language of the chapter and include Theorem 14 (Parallelogram Area Theorem) which is basic to Theorems 15, 16 and 17. These may be reviewed quickly or omitted as time allows.

The rest of the chapter may be covered by reviewing the area formulas and including a judicious selection of practice problems. Note the area postulate and definition on pages 404 and 405.

**Recommended Time Schedule:** Seven periods.

## CHAPTER XV

**Ratio and Proportion, Similar Figures**

It is suggested that sections 15.1 to 15.3 be taught; however, the Triangle Area Theorem developed in 15.4 may be accepted as a postulate. Sections 15.5 to 15.7 may be treated as in the text. The Pythagorean Theorem in 15.8 may be proven as on page 447, or as on page 412 or page 413. The converse of the Pythagorean Theorem may be taught or omitted as time permits.

**Recommended Time Schedule:** Twelve periods.

## BIBLIOGRAPHY

### Suggestions for the High School Mathematics Shelf

The following are a few of the many titles recommended for the mathematics section of a high school library. Some are for the teacher as background and enrichment; many are suitable for alert and interested students. Approximate prices have been given for most publications.

[books starred (marked with *) are particularly recommended]

*GENERAL REFERENCE:-*

| | |
|---|---|
| Mathematics Dictionary Van Nostrand, Toronto | James & James $10.75 less 20% |

*HISTORY AND BIOGRAPHY:-*

| | |
|---|---|
| Armitage, Angus | SUN, STAND THOU STILL. The life and work of Copernicus the Astronomer. New York, Schuman, 1947, 210 pages. |
| *Bell, E.T. | MEN OF MATHEMATICS. New York, Simon and Schuster, 1957, 592 pages. $6.50. A classic; contains piquant, terse characterizations of the personalities and achievements of some 35 outstanding mathematicians of all time. |
| Cahn, William | EINSTEIN: A PICTORIAL BIOGRAPHY. New York, Citadel Press, 1955, 128 pages (paper). |
| Cajori, Florian | A HISTORY OF ELEMENTARY MATHEMATICS. New York, Citadel Press, 1955, 128 pages (paper). |
| Freebury, H. A. | A HISTORY OF MATHEMATICS FOR SECONDARY SCHOOLS. London, Cassell, 1958. |
| Harsanyi, A. de. | THE STAR-GAZER. Trans. by Paul Tabor, New York, Putnam, 1939, 572 pages. Fictionalized biography of Galileo; intensely gripping. |
| Smith, D. E. and Ginsburg, J. | NUMBERS AND NUMERALS. Washington, D.C., National Council of Teachers of Mathematics, 1958, 52 pages, 35c. |
| Sullivan, J. W. M. | ISAAC NEWTON. 1642-1727. |

*MODERN MATHEMATICS:-*

| | |
|---|---|
| *Adler, Irving | THE NEW MATHEMATICS. New York, John Day, 1958, 187 pages, $3.75. |
| *Allendoerfer, C. B. and Oakley, C. O. | PRINCIPLES OF MATHEMATICS. New York, McGraw-Hill, 1955, 448 pages, $5.75. |
| Boehm, George A. W. and others | THE NEW WORLD OF MATHEMATICS. New York, Dial Press, 1959, 128 pages, $2.50 (paperback $1.50). |
| Dubisch | THE NATURE OF NUMBER; AN APPROACH TO BASIC IDEAS OF MODERN MATHEMATICS. Ronald Press, 1952, list price-$4.00. |
| | *24th Yearbook of National Council of Teachers of Mathematics. THE GROWTH OF MATHEMATICAL IDEAS, GRADES K-12 (NCTM, 1959). Non-members $5.00. |
| *Evenson, A. B. | MODERN MATHEMATICS, INTRODUCTORY CONCEPTS AND THEIR IMPLICATIONS. Toronto, W. J. Gage Ltd., 1962, 206 pages, $2.00. |

| | |
|---|---|
| Johnson and Glenn | EXPLORING MATHEMATICS ON YOUR OWN Series. Toronto, Longmans Green. This is a fascinating series of enrichment booklets tailored for students who want to go beyond the textbook. Each booklet in the series presents a stimulating topic in an informal easy-to-read style. Each booklet is complete in itself and may be used by students for individual work or by the class as a whole. Ample practice is provided. $1.00 each.<br>*—Sets, Sentences, and Operations.<br>—The Pythagorean Theorem.<br>*—Invitation to Mathematics.<br>*—Understanding Numeration Systems.<br>—Fun with Mathematics.<br>—Number Patterns.<br>*—Topology—the Rubber-Sheet Geometry.<br>—The World of Statistics.<br>—Short Cuts in Computing.<br>*—The World of Measurement.<br>—Adventures in Graphing.<br>—All About Computing Devices. |
| Keedy, Mervin L. | A MODERN INTRODUCTION TO BASIC MATHEMATICS. Reading, Massachusetts, Addison-Wesley Publishing Co.. Inc. 1963, 326 pages, $8.35. |
| *Kemeny, Snell, Thompson | INTRODUCTION TO FINITE MATHEMATICS. Englewood Cliffs, N.J., Prentice-Hall Inc., 1957, 372 pages. $8.25. |
| Krickenberger | SETS AND THE STRUCTURE OF ALGEBRA. Toronto, Ginn, pamphlet of 21 pages, 60c. A good introduction. |
| Ringenberg, L.A. | A PORTRAIT OF 2. Washington, D.C., National Council of Teachers of Mathematics, 1956, 42 pages (pamphlet), 75c. |
| Singh, Jagjit | MATHEMATICAL IDEAS: THEIR NATURE AND USE. London, Hutchinson, 1959, 312 pages. |

*NATURE OF MATHEMATICS:-*

| | |
|---|---|
| *Bell, E. T. | MATHEMATICS: QUEEN AND SERVANT OF SCIENCE. New York, McGraw-Hill, 1951, 437 pages. |
| *Court, Nathan, Altshiller | MATHEMATICS IN FUN AND IN EARNEST. New York. Dial Press, 1958, 250 pages. $4.75. |
| *Kline, Morris | MATHEMATICS AND THE PHYSICAL WORLD. New York, Thomas Y. Crowell Co., 1959, 482 pages, $6.50. |
| *Kline, Morris | MATHEMATICS IN WESTERN CULTURE. Oxford, 1953. $6.00. This book gives a remarkably fine account of the influence mathematics has exerted on the development of philosophy, the physical sciences. religion, and the arts in Western life. |
| Lieber, Lillian R. and Hugh G. | THE EDUCATION OF T. C. MITS. Norton, 1944, $3.95. A delightful, easy-to-read book that contains some interesting philosophy as well as mathematics. |
| Lieber, Lillian R. | With drawings by Hugh G. Lieber. NON-EUCLIDEAN GEOMETRY. Galois Institute, 1940, $1.95. Various geometries needed for different surfaces, treated postulationally, making Euclidean and non-Euclidean geometries easier and interesting. Very readable. |
| *Logsdon, M. I. | A MATHEMATICIAN EXPLAINS. University of Chicago Press, 1936. Brief, very readable. |
| *Hogben, Lancelot | WONDERFUL WORLD OF MATHEMATICS. New York. Doubleday, 1955, $2.95. |
| Huff | HOW TO LIE WITH STATISTICS. Norton, 1955, list price $1.95. Humorous, but penetrating and authorative explanation of the basic conceptions and misconceptions of statistics. Valid illustrations in cartoon style fully capture and even extend the content. |

Huff — HOW TO TAKE A CHANCE. Norton, 1959, list price, $2.95. Entertaining but soundly exact discussions of various aspects of chance, probability, and error, especially as applied to everyday life.

Newman, James R. — THE WORLD OF MATHEMATICS. 4 volumes, New York, Simon and Schuster, 1956, $20.00. (Recommended for large schools.) A veritable treasure house of every readable mathematical literature. Historical, biographical and expository, embracing mathematical development from ancient times to the present. Deals with the nature of mathematics, science and mathematics, mathematical thinking and invention, the cultural significance of mathematics and mathematical recreations. A unique anthology.

NEW MATHEMATICS LIBRARY. A series of eight books prepared under the direction of the School Mathematics Study Group "in order to make some important mathematical ideas interesting and understandable to a large audience of high school students and laymen". Authors and titles are:-

Beckenbach, Bellman—An Introduction to Inequalities.
Davis—The Lore of Large Numbers.
Kazarinoff—Geometric Inequalities.
Niven—Numbers: Rational and Irrational.
Salkind—The Contest Problem Book.
Sawyer—What is Calculus About?
Yaglom—Geometric Transformations.
Zippin—Uses of Infinity.

This series is published by the L. W. Singer Co. and is available from Random House of Canada Ltd., Toronto. $1.50 per book.

Sawyer, W. W. — PRELUDE TO MATHEMATICS. Baltimore, M.D. Penguin, 1955, 214 pages (paper). A stimulating popular exposition, including non-Euclidean geometry, matrix algebra, projective geometry, group theory.

Schaaf, W. L. — BASIC CONCEPTS OF ELEMENTARY MATHEMATICS. New York, John Wiley and Sons Inc., 1961, 386 pages, $6.00.

*RECREATIONAL MATHEMATICS:-*

Degrazia, Joseph — MATH IS FUN. New York, Gresham Press, 1948, 159 pages.

Gamow — ONE, TWO, THREE . . . INFINITY. Mentor Books, 1947, list price 40c. Problems of mathematics, physics, and astronomy clarified for the layman. This paperback should be available at the corner store.

Gardner, Martin — MATHEMATICS, MAGIC AND MYSTERY. New York, Dover, 1956, 176 pages. Emphasis on manipulative tricks and parlor magic involving mathematics.

Gardner, Martin — THE SCIENTIFIC AMERICAN BOOK OF MATHEMATICAL PUZZLES AND DIVERSIONS. New York, Simon and Schuster, 1959, 178 pages. A serious but lively presentation of significant aspects of mathematical recreation.

Jones, S. I. — MATHEMATICAL CLUBS AND RECREATIONS. Nashville, Jones, 1940, 256 pages. Indispensable for mathematics club programs and activities.

*Kraitchik — MATHEMATICAL RECREATIONS. Dover, 1953, list price $1.75. One of the most thorough compilations of recreational mathematical problems. Highly recommended.

Mott-Smith, Geoffrey — MATHEMATICAL PUZZLES FOR BEGINNERS AND ENTHUSIASTS. New York, Dover, 1955, 248 pages, $1.00. Unusually fine collection of mathematical recreations, well presented.

## *ADDITIONAL BOOKS FOR THE TEACHERS' SHELF*

18th Yearbook N.C.T.M. 1945. MULTI-SENSORY AIDS IN TEACHING MATHEMATICS. The most complete discussion available of teaching aids for mathematics. Fourth printing recently completed. 460 pages — $3.00.

21st Yearbook N.C.T.M. 1953. LEARNING OF MATHEMATICS, ITS THEORY AND PRACTICE. Applies the latest theories of the nature of the learning process to the problems of the classroom. 364 pages—$4.00. ($3.00 to members of the Council.)

*25th Yearbook N.C.T.M. 1960. INSTRUCTION IN ARITHMETIC. 374 pages, $3.50 and $4.50. Discusses value, nature and structure of arithmetic; factors affecting learning in arithmetic; modern mathematics and its impact on arithmetic; etc.

Butler and Wrenn: THE TEACHING OF SECONDARY MATHEMATICS. 1963 edition. McGraw-Hill. 550 pages, $7.20. This represents a complete revision of the earlier text. Implications of modern mathematics are carefully discussed and many suggestions are given for inclusion of appropriate materials within the framework of existing high school courses. The book should prove very helpful to Alberta teachers who are seeking to include aspects of modern mathematics in their current teaching.

Reeve, W. D.: MATHEMATICS FOR THE SECONDARY SCHOOLS. 1956. Holt, pages 547. Contains particularly good chapters on the teaching of geometry, both informal and demonstrative.

## *PERIODICALS*

*The Mathematics Teacher* (8 times a year). Official journal of the National Council of Teachers of Mathematics, 1201 Sixteenth Street N.W., Washington, D.C. Teachers' membership including subscription, $5.25. Library rate $7.25 — a 'first' for teachers specializing in high school mathematics.

*School Science and Mathematics* (9 times a year, $4.50). P.O. Box 408, Oak Park, Illinois — official journal of Central Association of Science and Mathematics Teachers.

*Scientific American* (monthly). 415 Madison, New York 17, New York.

*Mathematics Students Journal* (quarterly—5 subscriptions for $1.50, minimum order). N.C.T.M.—1201 Sixteenth Street N.W., Washington, D.C. Good for high school mathematics clubs, enrichment classes, etc. Schools wishing to have more complete book list should obtain one or more of the following:

*1. *A Guide to the Use and Procurement of Teaching Aids for Mathematics*—Berger and Johnson, 75c.

2. *The High School Mathematics Library* — Wm. L. Shaaf—40c. A very complete book list under 15 topics.

   Both of the above are available from National Council of Teachers of Mathematics, 1201 Sixteenth Street N.W., Washington 6, D.C.

3. *Mathematics Book List for High School Libraries.* National High School and Junior College Mathematics Club, Mu Alpha Theta, Box 1155, University of Oklahoma, Norman, Oklahoma. (Send only self-addressed, stamped, No. 10 envelope.)

DATE DUE SLIP

| | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| F255 | O |

QA 14 C22 A3 A3152 1965
ALBERTA DEPT OF EDUCATION
CURRICULUM GUIDE FOR
MATHEMATICS 10 --
39841050 CURR HIST

*000017747627*

QA 14 C22 A3 A3152 1965
Alberta. Dept. of Education.
Curriculum guide for
mathematics 10. -
39841050 CURR HIST

CURRICULUM GUIDE

For Reference

NOT TO BE TAKEN FROM THIS ROOM

EXCEPT WITH LIBRARIAN'S PERMISSION